

CLAIMS

1. An encapsulation material for an electronic module, the encapsulation material comprising: a polymer matrix material; and electrically-conductive phase change particles dispersed in the matrix material, the phase change particles being encapsulated by a dielectric coating so as to be electrically insulated from each other.

2. The encapsulation material according to claim 1, wherein the matrix material is formed of a silicone gel and the phase change particles are formed of a solder alloy.

3. The encapsulation material according to claim 2, wherein the solder alloy comprises indium, tin, bismuth, lead, zinc, cadmium, copper, silver and/or gold.

4. The encapsulation material according to claim 1, further comprising dielectric particles dispersed in the matrix material, the dielectric particles having a higher coefficient of thermal conductivity than the matrix material.

5. The encapsulation material according to claim 4, wherein the dielectric particles are formed of a ceramic material.

6. The encapsulation material according to claim 4, wherein the dielectric coating comprises second dielectric particles dispersed in a dielectric matrix, the second dielectric particles being smaller than the dielectric particles dispersed in the matrix material.

7. The encapsulation material according to claim 6, wherein

the second dielectric particles are formed of a ceramic material having a higher coefficient of thermal conductivity than the matrix material.

8. The encapsulation material according to claim 1, wherein the dielectric coating is a polymer capable of containing the phase change particles when molten.

9. The encapsulation material according to claim 1, wherein the dielectric coating comprises dielectric particles dispersed in a dielectric matrix.

10. The encapsulation material according to claim 9, wherein the dielectric particles are formed of a ceramic material having a higher coefficient of thermal conductivity than the matrix material.

11. The encapsulation material according to claim 1, wherein the encapsulation material contacts a heat-generating power device.

12. The encapsulation material according to claim 1, wherein the encapsulation material contacts a heat sink of a heat-generating power device.

13. An encapsulation material contacting an electronic assembly, the encapsulation material comprising:

about 50 to about 80 weight percent of electrically-conductive phase change particles comprising a solder alloy encapsulated by a dielectric polymer coating so as to be electrically insulated from each other, the dielectric polymer coating being capable of containing the phase change particles when molten;

about 0.5 to about 10 weight percent of dielectric particles; and
the balance essentially a silicone gel in which the electrically-conductive phase change particles and the dielectric particles are dispersed, the dielectric particles having a higher coefficient of thermal conductivity than the silicone gel.

14. The encapsulation material according to claim 13, wherein the dielectric particles are formed of alumina, boron nitride, aluminum nitride, silicon carbide and/or silicon nitride.

15. The encapsulation material according to claim 13, wherein the dielectric polymer coating contains about 50 to about 90 weight percent of second dielectric particles dispersed in a polymer matrix, the second dielectric particles having a higher coefficient of thermal conductivity than the silicone gel.

16. The encapsulation material according to claim 15, wherein the second dielectric particles are formed of alumina, boron nitride, aluminum nitride, silicon carbide and/or silicon nitride.

17. The encapsulation material according to claim 15, wherein the second dielectric particles are smaller than the dielectric particles dispersed in the silicone gel.

18. The encapsulation material according to claim 13, wherein the encapsulation material surrounds and contacts a heat-generating electronic device.

19. The encapsulation material according to claim 13, wherein the encapsulation material contacts a heat sink of a heat-generating electronic device.

20. The encapsulation material according to claim 13, wherein the solder alloy is at least one alloy selected from the group consisting of 52In/48Sn, 75In/25Sn, 46.1Bi/34.2Sn/19.3Pb, 55.5Bi/45.5Pb, 56Bi/40Sn/4Zn, 58Bi/42Sn, 60Bi/40Cd, In, 70Sn/18Pb/12In and 63Sn/37Pb.

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